

## Supporting Information for

### 4-Iodo-1H-imidazole Dramatically Improving the Open-circuit Voltages of Perovskite Solar Cell Exceeding 1.2 V

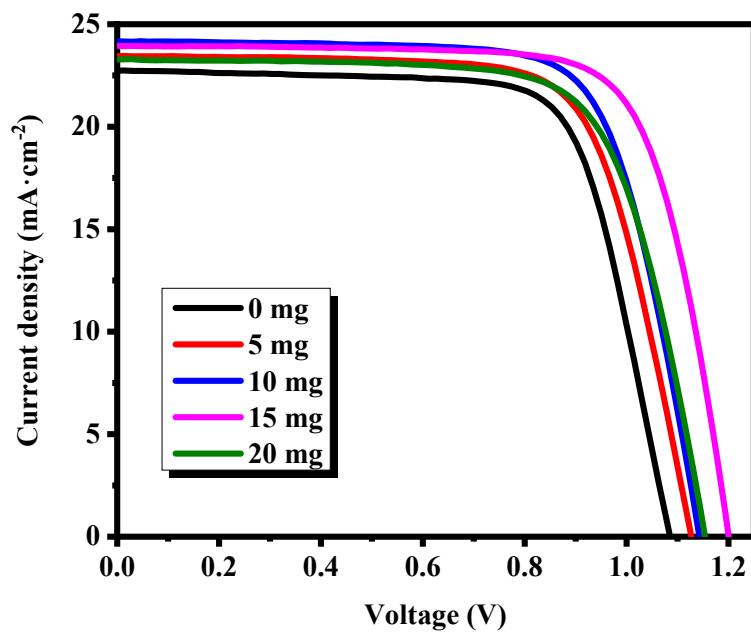
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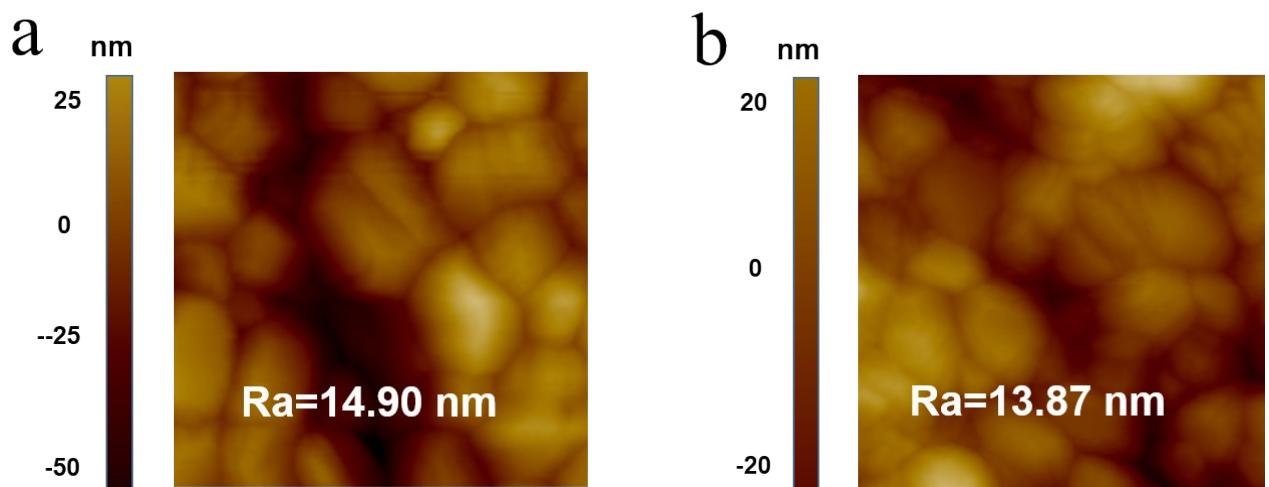
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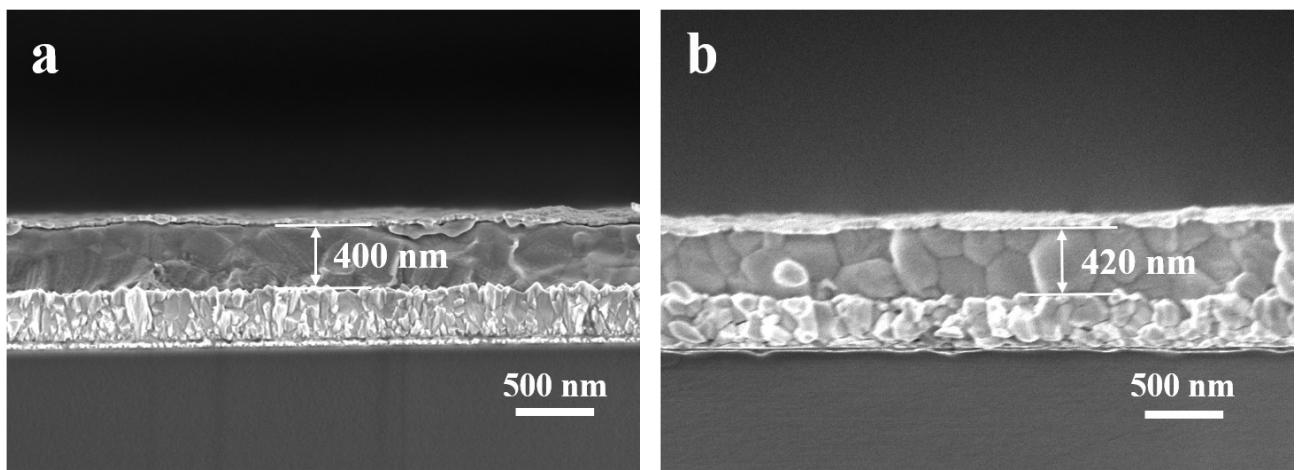
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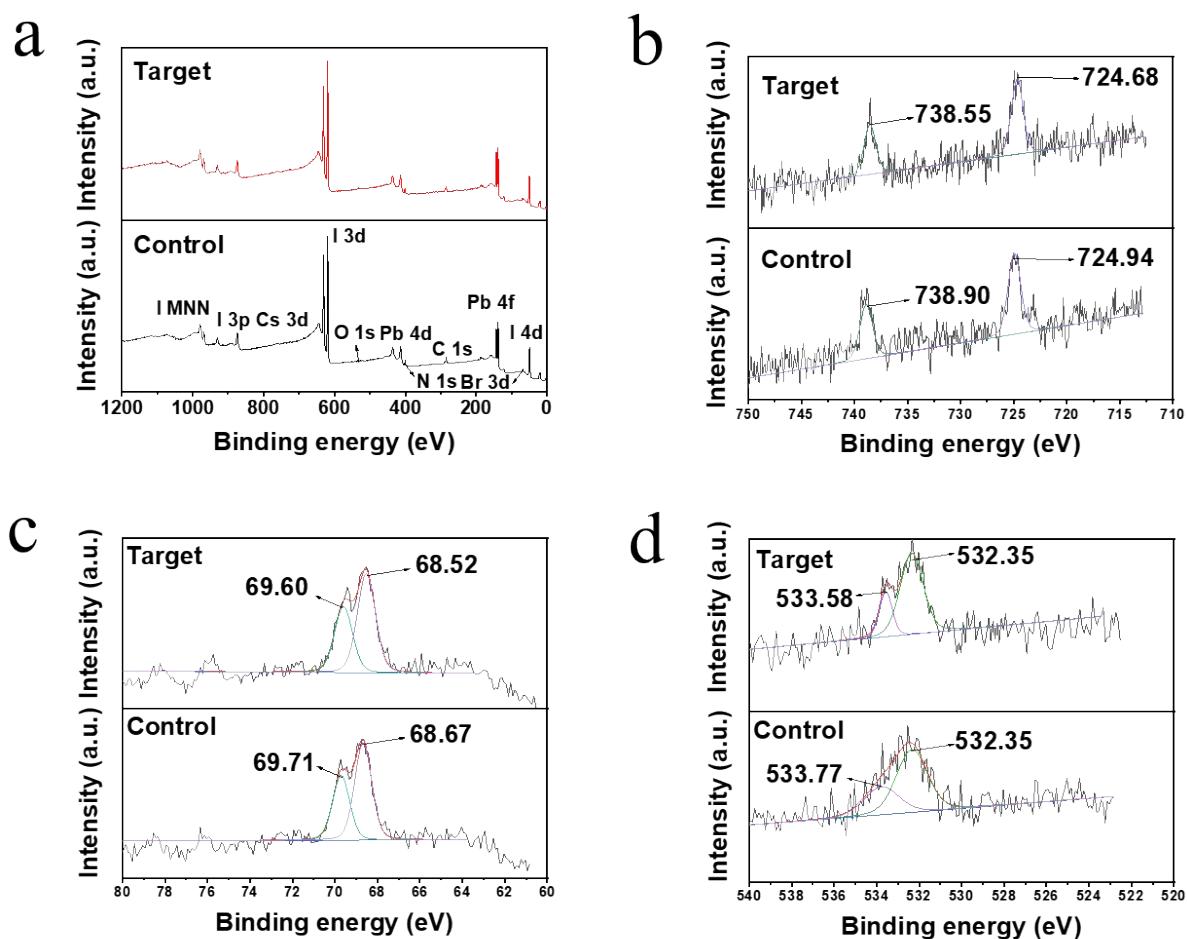
**Figure S1** J-V curves of different concentration



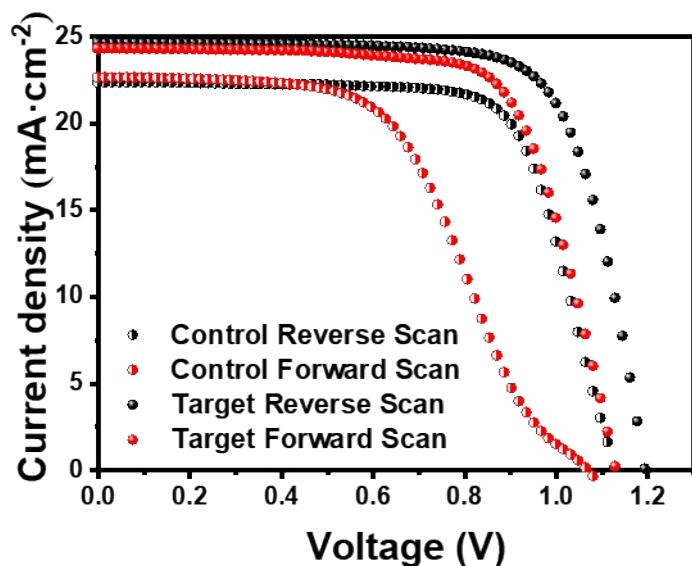
**Figure S2** (a) AFM images of the control perovskite film, (b) AFM images of the target perovskite film.



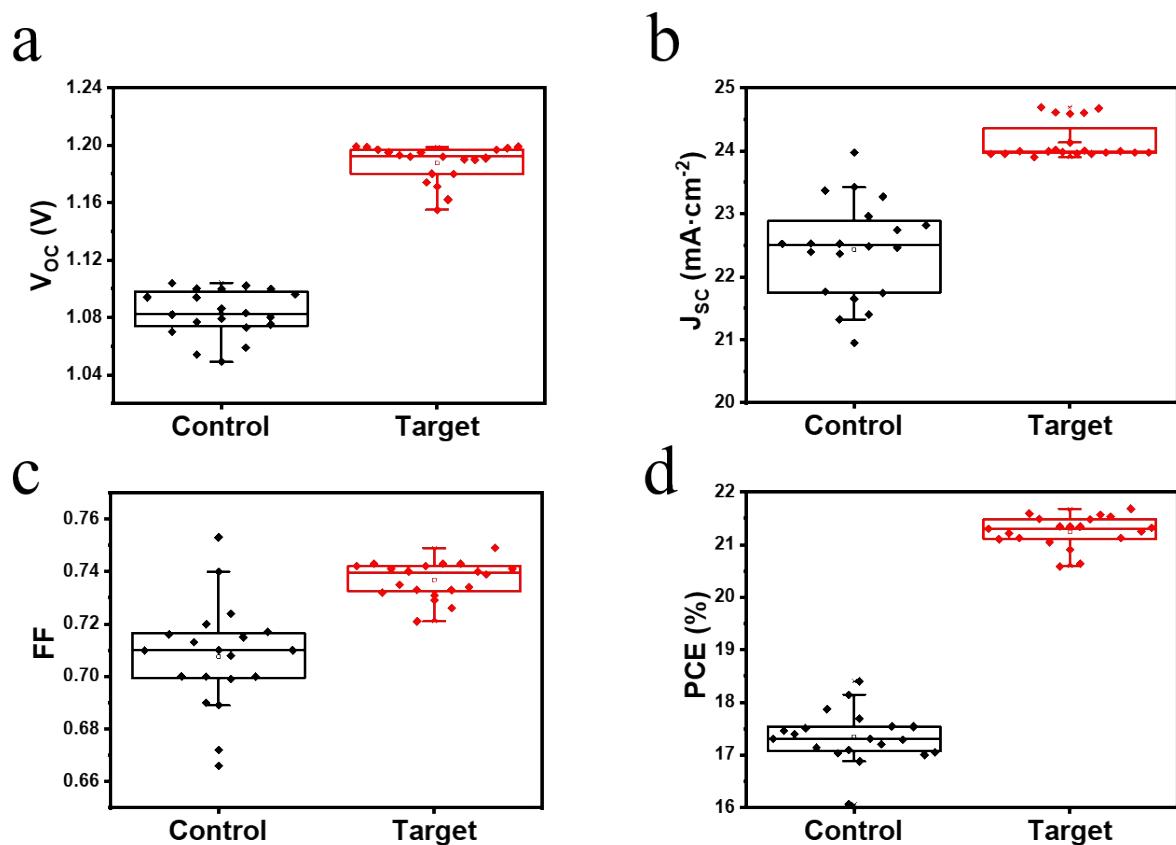
**Figure S3** Cross-sectional view FESEM images of PSCs assembled with (a) the control perovskite film and (b) the target perovskite film.



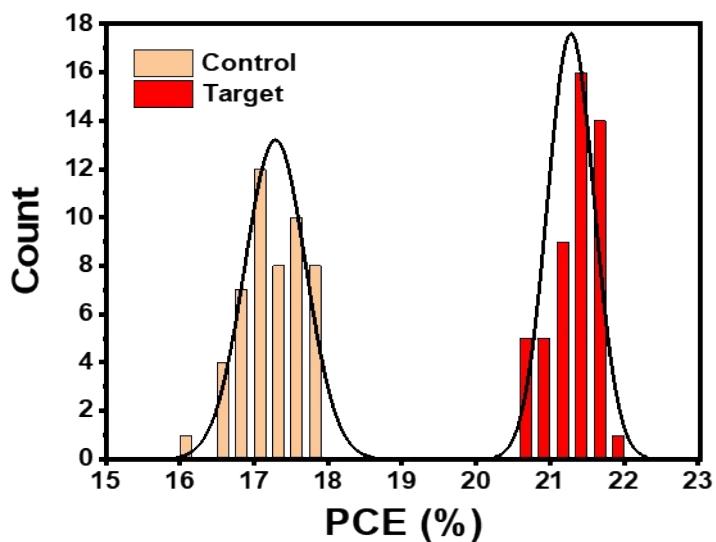
**Figure S4** (a) Survey spectra, (b) high resolution XPS spectra of Cs 3d, (c) high resolution XPS spectra of Br 3d, (d) high resolution XPS spectra of O 1s.



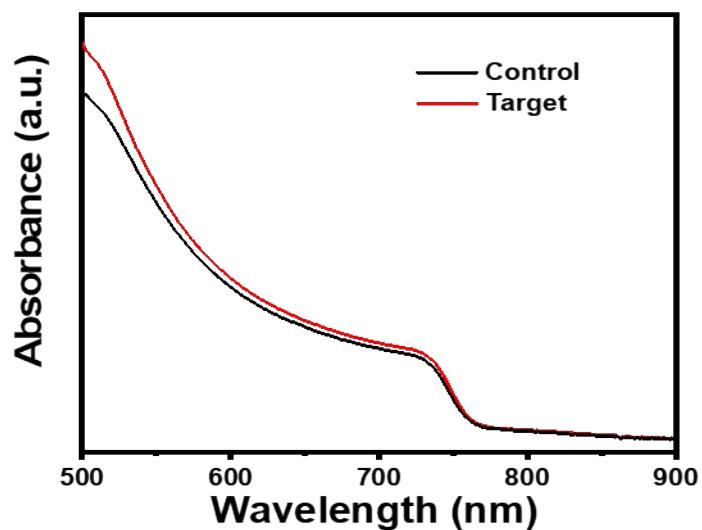
**Figure S5** J-V curves in the forward and reverse scan of a random device.



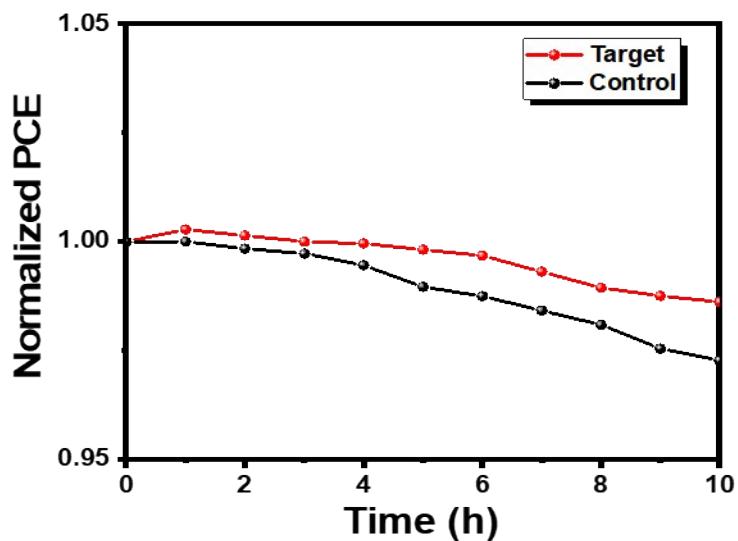
**Figure S6** Box plots of the photovoltaic parameters for 50 independent PSCs fabricated under the same experimental conditions.



**Figure S7** PCE distribution of the control and target PSC devices.



**Figure S8** UV-vis absorption spectra for the control and target perovskite films.



**Figure S9** Light stability tests of the devices without encapsulation under AM 1.5G illumination.

**Table S1** The performance parameters of a random device in the forward and reverse scan.

| Device         | Scan Direction | V <sub>oc</sub> (V) | J <sub>SC</sub> (mA·cm <sup>-2</sup> ) | FF    | PCE (%) |
|----------------|----------------|---------------------|--|-------|---------|
| <b>Control</b> | Reverse Scan   | 1.129               | 22.39                                  | 0.717 | 18.15   |
|                | Forward Scan   | 1.055               | 22.65                                  | 0.536 | 12.80   |
| <b>Target</b>  | Reverse Scan   | 1.209               | 23.95                                  | 0.749 | 21.68   |
|                | Forward Scan   | 1.129               | 24.32                                  | 0.707 | 19.42   |